

Deepwater Horizon Oil Spill Environmental Data Review Assumptions and Comparison Values for Chemicals

Introduction: A major challenge facing public health professionals involved in environmental disasters is the evaluation and interpretation of environmental sampling data. A valuable method to assist in such a task is to evaluate the sampling results from many perspectives, then merge those perspectives into a single picture of the significance to human health and the environment. As part of this process, the U.S. Environmental Protection Agency (EPA) routinely shares its data with other federal agencies before releasing the results and the interpretation of those results. Among EPA's partners in this process are the Centers for Disease Control and Prevention (CDC) and the Agency for Toxic Substances and Disease Registry (ATSDR). This routine practice was initiated during the response to the Deepwater Horizon Oil Spill (also known as [aka], Mississippi Canyon Block 252 Oil Spill or the British Petroleum Macondo Well Blowout).

CDC and ATSDR use a two-step process to estimate the human health implications of environmental data. Because humans must come into contact with a hazard for a risk of harm to exist, scientists first evaluate environmental data to determine if the concentration is sufficiently high to indicate a potential hazard. Next, they must determine if there is a potential for humans to be exposed to (i.e., come into contact with) the hazard. In order for harm to occur, humans have to be exposed to a sufficient quantity of the hazard for a sufficient period of time. However, because every person is unique, it is possible that some people may be unaffected by a substance, while others may be affected strongly.

Comparison values to identify a potential hazard: The accompanying tables list comparison values developed by CDC and ATSDR for environmental substances that may be related to the Deepwater Horizon Oil Spill. The samples collected during the response were of the general environment in areas where oil pollution was discovered many miles from the source of the release. It is possible that the reported substances were not present due to the oil spill but due to other factors. For instance, salt water contains many metals and crude oil also contains some metals. It is not possible to differentiate the metals from the crude oil from the metals naturally found in salt water based on the information presented here. For this incident, these comparison values represent a concentration of a substance in a specific environmental medium. Under the exposure assumptions made below, a majority of the population would not be expected to experience any harmful effects at or below the listed concentration. If no one is exposed to the substance, no harm is possible. Comparison values are an indicator of the need for further review and assessment. Comparison values do not predict adverse health effects, nor should they be used for setting clean-up levels.

Stated another way, if toxicity were a room, comparison values would be the "floor". Health effects would not be expected to occur until one reaches the "ceiling". The "height" of the room could therefore be considered analogous to the uncertainty factor listed for each substance in the table.

CDC and ATSDR use the highest quality data available to assess the health implications of environmental data. Common sources of data include

- ATSDR's Minimal Risk Levels;
- EPA's Reference Doses and Reference Concentrations;

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- Acute Exposure Guideline Levels developed by a consortium of professional organizations, including ATSDR, EPA, the Occupational Safety and Health Administration (OSHA), and the National Institute for Occupational Safety and Health (NIOSH);
- Regulatory standards and guidelines developed by recognized organizations [e.g., EPA, the U.S. Food and Drug Administration (FDA), the World Health Organization (WHO), the National Academy of Sciences (NAS,)]; and
- Staff reviews of general toxicological information for those substances for which standards and guidance values are not readily available. Preference will be given to high quality human data rather than animal data, whenever possible.

In some cases, site-specific recommendations for similar contaminants from other sites or spills may be used as the comparison value. Many of these values are given in doses of contaminant per body weight, usually milligram or microgram of pollutant per kilogram of body weight. CDC and ATSDR convert these doses to environmental concentrations commonly referred to as Environmental Media Evaluation Guides (EMEG) by use of the following assumptions.

- An EMEG is an environmental concentration in air, soil, or water below which no adverse non-cancer health effects are expected to occur.
- EMEGs are derived from ATSDR's Minimal Risk Level (MRL), and they are expressed for short-term or acute exposure durations (up to 14 days), mid-term or intermediate exposure durations (up to a year), and long-term or chronic exposure durations (anything more than a year).
- EMEGs are used in selecting environmental contaminants for further evaluation.

CDC and ATSDR refer to comparable comparison values that are derived from EPA reference doses or concentrations as RMEGs.

EMEG values can be stated as a range of values that span the exposure potential for different segments of the population. RMEG values are generally assumed to be lifetime exposures.

For soil, sediments, or solids, EMEGs are calculated from MRLs as:

$$\text{EMEG soil (mg/kg)} = (\text{MRL (mg/kg/day)}) \times (\text{Body Weight (kg)}) \div (\text{Soil Ingestion Rate (mg/day)}) \times (10^{-6} \text{ kg/mg})$$

For water, EMEGs are calculated from MRLs as:

$$\text{EMEG water } (\mu\text{g/L}) = (\text{MRL (ug/kg/day)}) \times (\text{Body Weight (kg)}) \div \text{Ingestion Rate (L/day)}$$

EMEGs are calculated with the following assumptions:

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	Body Weight In Kilograms (kg)	Water Ingestion In Liters per day (l/day)	Soil Intake In milligrams of soil per day (mg/day)
Adult	70 kg	2 l/day	100 mg/day
Child	10 kg	1 l/day	200 mg/day
Pickup	10 kg	1 l/day	5000 mg/day

Because the Gulf of Mexico and its coastlines are large, samples may not be representative of all possible exposures. Isolated locations with higher or lower concentrations are inevitable. In addition, contaminants in the air, water, and/or sediments will not be uniformly distributed in any dimension. Therefore, usually the maximum value reported for any given location will be assumed to be the value for that location.

Exposure Assumptions: CDC and ATSDR assume the following potential exposure scenarios for how people may come into contact with hazards potentially identified by a comparison value:

- * In the development of comparison values for water, CDC and ATSDR use a conservative approach that considers all samples to be from primary drinking water sources, even though most if not all such samples are from non-potable ocean or brackish water sources.
- * If significant oil contamination reaches areas where human exposure may occur, completion of response operations may take several weeks. In most cases, CDC and ATSDR anticipate that any areas where human exposure may be occurring would be a priority for cleanup in order to control exposures as quickly as possible.
- * Responders will be healthy adults trained to protect themselves from the hazards. Other persons who might be exposed will be more representative of the general population.
- * Responders will wear personal protective equipment, as recommended by NIOSH/OSHA and in compliance with site health and safety plans.
- * The target population is generally considered to be the most sensitive segment of the population that is potentially exposed to contamination at a site. This sensitive segment will consist of children, unless otherwise indicated.
- * If concentrations are below comparison values for ingestion, then dermal absorption is generally not an issue. This assumption allows for only ingestion comparison values to be used in the review of the environmental data.
- * For non-carcinogenic compounds, the assumptions allow the use of acute and intermediate level comparison values for air, and the use of intermediate and chronic values for waters and sediments.
- * For known or suspected carcinogens: The comparison value for any compounds with cancer slopes established by the EPA will be the lifetime 10^{-6} cancer risk. For any

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compounds without EPA cancer slopes and identified in the “National Toxicology Program 11th report on Carcinogens,” the comparison value will be the chronic or intermediate non-carcinogenic values identified in the section on comparison values above. Cancer risks are estimates of an increased incidence of cancer across a group of people over a lifetime of exposure; the risk estimates are not a predictor of cancer in specific persons.

- * In order to facilitate rapid response and recovery operations, reported concentrations that do not significantly exceed comparison values will be considered as being at the comparison value. For instance, a concentration within a factor of 10 of a comparison value with an uncertainty factor of 1000 would not significantly exceed the comparison value. If the comparison value had an uncertainty factor of 3, then a concentration 10 times the comparison value could be significant. Use of this assumption maximizes the flexibility of responders in the field to conduct operations, while it reduces the disruption to the community.
- * Crude oil is a naturally occurring substance. Non-naturally occurring contaminants identified in a sample (e.g., hydrocarbons containing chlorine or other halogens) cannot be part of the crude oil. In their evaluations, CDC and ATSDR will identify such compounds and attempt to evaluate their significance for human health in relation to the spill. Significant concentrations of such unrelated substances will be referred to local authorities as information, and any appropriate action by those authorities will be outside the oil spill response.
- * CDC and ATSDR evaluated the environmental monitoring data for the Deepwater Horizon Oil Spill daily, looking for levels that may exceed the health-based comparison values (CVs) listed in the tables below. Because the science for evaluating the impact of exposure to chemical mixtures is still being developed, the CDC and ATSDR evaluations are based on the CV for each individual chemical. Public health recommendations are then developed to prevent or reduce exposures that are found to exceed a chemical-specific CV.

Comparison Value Tables Entries: The tables below include endnotes to help explain or amplify individual entries.

“Substances” listed in the tables will be those detected in environmental sample analysis provided to CDC and ATSDR for review and comment. Substances normally analyzed for but not detected in the environmental sample analysis are not listed here.

“Comparison Values” are the concentrations in the most common units that are not expected to result in harm. Values in italics represent units that are different from standard laboratory reports.

“Basis” is the acronym for the health guidance value or other basis for determining the Comparison Value.

- “RfD” refers to the Reference Dose, as reported on the EPA Integrated Risk Information System (IRIS) Website (www.epa.gov/iris).
- “RfC” refers to the Reference Concentration, as reported on the IRIS website.

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- “MRL” refers to the ATSDR Minimal Risk Levels, as reported in the ATSDR Toxicological Profile for the substance and on the ATSDR Website at www.atsdr.cdc.gov.
- “Int.” refers to an intermediate exposure duration; ATSDR defines intermediate exposure as 15–364 days of continuous exposure.
- “Chr.” refers to a chronic exposure duration; ATSDR defines chronic exposure as 365 days or more of continuous exposure.
- “Derived” refers to comparison values developed by CDC or ATSDR staff specifically for this incident on the basis of available toxicological or chemical information. Such derived values should not be applied generally to other sites without further evaluation.
- “Carc.” refers to a known or suspected human cancer-causing compound. The value reported as a comparison value is commonly referred to as a “CREG”. It represents the concentration at which one cancer case can be expected in a group of one million people when that group is exposed to that concentration continuously for 70 years. Individual risks for developing cancer are not captured in this value, for such individual risks are dependent on several other factors.
- “DRI” refers to Dietary Reference Intake, similar to the older Recommended Daily Allowance. The DRI is applied to essential human nutrients when no other health guidance value is available. DRIs are listed by the Food and Nutrition Information Center of the U.S. Department of Agriculture at <http://fnic.nal.usda.gov>.
- Other abbreviations in this column of the tables are explained in the corresponding endnote.

“UF/MF” refers to uncertainty and modifying factors. Uncertainty factors (UF) are a measure of the confidence that a developer has in the ability of a comparison value to represent human health outcomes. Put another way, uncertainty factors reflect deficiencies in specific areas of the available toxicological data on a substance. The larger the number, the less confidence the developer has that the underlying study represents human outcomes. Modifying factors (MF) are used when necessary to adjust the results of a study to a standard exposure scenario. These factors are not added simply to increase safety; rather, they exist to adjust the results of a study so that they can be applied to the general population. Please see the ATSDR Public Health Assessment Guidance Manual available at www.atsdr.cdc.gov for further details on the derivation of these values.

In addition to the review by ATSDR, environmental data packages are being independently review by other agencies and programs. These other reviewers have developed their own assessment tools and procedures. EPA risk assessors have developed benchmarks that CDC/ATSDR have reviewed and concurred with. It is perhaps important to note that EPA is considering the most likely exposure scenarios (e.g., swimming at the beach) and has based their benchmarks on those exposures. ATSDR has opted to begin with the potential hazards to the most sensitive populations no matter what the exposure scenario and then assess the possible human exposure to that potential hazard. Both approaches have advantages and disadvantages. Both are appropriate, which is why CDC/ATSDR concurred with the EPA approach. The fact that a different approach is used in our reviews is actually a strength of the interagency cooperation inherent in our relationship. When both the most likely exposure scenario and the most sensitive hazard assessment reach the same conclusion, that provides an added level of

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confidence that the public is protected. If the results of the separate analysis should differ, that is an indicator that further assessment is necessary. As of this writing, there have been no significant difference in the results of the analysis.

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Comparison Values for Air

Substance	Comparison Value	Basis	UF/MF
Acenaphthene	5 ug/m3	RfC	30
Acenaphthylene	5 ug/m3	RfC	30
Acetaldehyde	9 ug/m3	RfC	100 0
Acetylene	1065 mg/m3	Deriv ed	100
Acetone	30,000 ug/m3	Int. MRL	100
Acetonitrile	60 ug/m3	RfC	100 0
Acrolein	0.02 ug/m3	RfC	100 0
Acrylonitrile	0.01 ug/m3	Carc.	N/A
Anthracene	5 ug/m3	RfC	30
Benzene	0.1 ug/m3 0.04 ppb	Carc.	N/A 6
Benzo(a)anthracene	0.002 ug/m3	Carc	N/A
Benzo(a)pyrene	0.002 ug/m3	Carc	N/A
Benzo(b)fluoranthene	0.002 ug/m3	Carc	N/A
Benzo(e)pyrene	5 ug/m3	RfC	30
Benzo(g,h,i)Perylene	5 ug/m3	RfC	30
Benzo(k)fluoranthene	0.002 ug/m3	Carc	N/A
Bromodichloromethane	670 ug/m3	Deriv ed	100
Bromofluorobenzene	670 ug/m3	Deriv ed	100
Bromomethane (aka, Methyl Bromide)	20 ug/m3	Chr MRL	100
Butadiene	0.03 ug/m3	Carc	N/A
Butane	6000 ug/m3	Deriv ed	100
Butene	11,500 ug/m3	Deriv ed	100 0
2-Butoxyethanol	(200 ppb)	Chr MRL	3
Butylbenzene	4000 ug/m3	Deriv ed	100 0
Butylcyclohexane	24000 mg/m3	Deriv ed	300
Carbon Disulfide	700 ug/m3	RfC	30

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Carbon Tetrachloride	0.2 ug/m3	Carc	N/A
Chlorobenzene	1.5 ug/m3	Deriv ed	100 0
Chloroform	0.04 ug/m3	Carc.	N/A
Chloroethane	10,000 ug/m3	RfC	300
Chloromethane	400 ug/m3	Int. MRL	300
3-Chloropropene	1 ug/m3	RfC	30
Chlorotoluene	21 ug/m3	Deriv ed	100 0
Chrysene	0.002 ug/m3	Carc	N/A
Coronene	5 ug/m3	RfC	30
Cyclohexane	6000 ug/m3	RfC	300
Cyclopentane	110 ug/m3	Deriv ed	100 0
Cyclopentene	139 ug/m3	Deriv ed	100 0
Decane	31,000 ug/m3	Deriv ed	100
Dibenz(a,h)anthracene	0.002 ug/m3	Carc	N/A
Dibromochloromethane	670 ug/m3	Deriv ed	100
1,2-Dibromoethane	0.002 ug/m3	Carc.	N/A
1,4-Dichlorobenzene	60 ug/m3	Chr MRL	30
1,1 – Dichloroethene	80 ug/m3	Int. MRL	100
1,2-Dichloroethane	0.04 ug/m3	Carc.	N/A
1,2-Dichloropropane	30 ug/m3	Int. MRL	30
1,3-Dichloropropene	0.3 ug/m3	Carc.	N/A
Diethylbenzene	2196 ug/m3	Deriv ed	100
2,2-Dimethylbutane	176 ug/m3	Deriv ed	100 0
Dimethylcyclohexane	<i>240,000 mg/m3</i>	Deriv ed	300
Dimethyldecane	<i>9300 mg/m3</i>	Deriv ed	100
Dimethylheptane	<i>12,300 mg/3</i>	Deriv ed	100
Dimethyloctane	<i>10,500 mg/m3</i>	Deriv ed	100 0
2,3-Dimethylpentane	204 ug/m3	Deriv ed	100 0

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Dimethylundecane	687 ug/m3	Deriv ed	100 0
Dipropylene Glycol Butyl Ether	20,000 ug/m3 (2.6 ppm)	Deriv ed	100
1,4 – Dioxane	1000 ug/m3	Int. MRL	30
Dodecane	1000 mg/m3	Deriv ed	100
Dodecene	6900 ug/m3	Deriv ed	100 0
Ethane	62 ug/m3	Deriv ed	100 0
Ethanol	26,000 ug/m3	Deriv ed	100
Ethylbenzene	3000 ug/m3	Int. MRL	300
Ethylcyclohexane	2400 mg/m3	Deriv ed	300
Ethylene	11,500 ug/m3	Deriv ed	100
4-Ethyltoluene	4000 ug/m3	Deriv ed	100 0
Fluorathene	5 ug/m3	RfC	30
Fluorene	5 ug/m3	RfC	30
9-Fluorenone	5 ug/m3	RfC	30
Freon 11 (aka, trichlorofluoromethane)	50,000 ug/m3	RfC	100
Freon 12 (aka, dichlorodifluoromethane)	50,000 ug/m3	RfC	100
Freon 113 (aka, 1,1,2-Trichloro-1,2,2-trifluoroethane)	40,000 ug/m3	Deriv ed	100 0
Freon 114 (aka, Dichlorotetrafluoroethane)	87,000 ug/m3	Deriv ed	100 0
Heptane	41,000 ug/m3	Deriv ed	100
Heptene	201 ug/m3	Deriv ed	100 0
Hexane	700 ug/m3	RfC	300
Hexene	10,300 ug/m3	Deriv ed	100
Indeno(1,2,3-cd)pyrene	0.002 ug/m3	Carc	N/A
Isobutane	59,000 ug/m3	Deriv ed	100 0
Isobutene	11,000 mg/m3	Deriv ed	100 0
Isopentane	2.7 ug/m3	Deriv ed	100

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Isoprene (aka, methylbutadiene)	2200 ug/m3	Deriv ed	100 0
Methyl Butane	12,000 ug/m3	Deriv ed	100 0
Methylbutene (all isomers)	143 ug/m3	Deriv ed	100 0
Methyl Butyl Ketone (aka, 2-Hexanone)	30 ug/m3	RfC	300 0
Methyl Cyclohexane	48,000 ug/m3	Deriv ed	300
Methylcyclopentane	<i>103 mg/m3</i>	Deriv ed	100
Methyldecane	<i>930 mg/m3</i>	Deriv ed	100
Methylene Chloride (aka, dichloromethane)	2 ug/m3	Carc.	N/A
Methyl Ethyl Ketone (aka, 2-Butanone)	5000 ug/m3	RfC	300
Methylheptane	4672 ug/m3	Deriv ed	100 0
Methylhexane	205 ug/m3	Deriv ed	100 0
Methyl isobutyl Ketone (aka, 4-methyl-2- pentanone)	3000 ug/m3	RfC	300
Methyl Methacrylate	700 ug/m3	RfC	10
Methylnaphthalene	67 ug/m3	Deriv ed	100 0
Methylnonane	582 ug/m3	Deriv ed	100 0
Methyloctane	<i>1050 mg/m3</i>	Deriv ed	100 0
Methylpentane	30,000 ug/m3	Deriv ed	100
4-Methyl-1-Pentene	172 ug/m3	Deriv ed	100 0
Methylundecane	69 ug/m3	Deriv ed	100 0
Naphthalene	3 ug/m3	RfC	300 0
Nonane	19, 000 ug/m3	Deriv ed	100
Nonene	50 ug/m3	Deriv ed	100 0
Octane	35,000 ug/m3	Deriv ed	100 0

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Octene	60,000 ug/m3	Deriv ed	100
Particulate Matter (PM) 2.5 microns	35 ug/m3	NAA QS	N/A
Particulate Matter (PM) 10 microns	150 ug/m3	NAA QS	N/A
Pentane	30,000 ug/m3	Deriv ed	100
Pentene	143 ug/m3	Deriv ed	100 0
Pentylcyclohexane	6000 ug/m3	Deriv ed	300
Perylene	5 ug/m3	RfC	30
Phenanthrene	5 ug/m3	RfC	30
Pinene	1390 ug/m3	Deriv ed	100
Propanol	13,000 ug/m3	Deriv ed	100
Propyl Benzene (aka, Cumene)	400 ug/m3	RfC	100 0
Propane	13,500 ug/m3	Deriv ed	100
Propene	7190 ug/m3	Deriv ed	100
Propylene	3400 ug/m3	Deriv ed	100
Propylene Glycol	30 ug/m3 (9 ppb)	Int. MRL	100 0
Pyrene	5 ug/m3	RfC	30
Retene	5 ug/m3	RfC	30
Styrene	900 ug/m3	Chr MRL	100
Tetrachloroethene (aka, Perchloroethylene)	300 ug/m3	Chr MRL	100
Tetradecane	1700 mg/m3	Deriv ed	100
Tetrahydrofuran	17,700 ug/m3	Deriv ed	100
Toluene	300 ug/m3 (80 ppb)	Chr. MRL	100
1,2,4 – Trichlorobenzene	200 ug/m3	Deriv ed	100 0
1,1,1 – Trichloroethane	4000 ug/m3	Int. MRL	100
1,1,2-Trichloroethane	0.06 ug/m3	Carc.	N/A

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Trichloroethene	500 ug/m3	Int. MRL	300
Tridecane	2833 mg/m3	Deriv ed	100
Tridecene	50 ug/m3	Deriv ed	100 0
1,2,3-Trimethylbenzene	123 ug/m3	Deriv ed	100 0
1,2,4 – Trimethylbenzene	16,000 ug/m3	Deriv ed	100
1,3,5 – Trimethylbenzene	5000 ug/m3	Deriv ed	100
Trimethylcyclohexane	3000 mg/m3	Deriv ed	300
Trimethylpentanes (aka, iso-octane)(all isomers)	234 ug/m3	Deriv ed	100 0
Undecane	2.29 ug/m3	Deriv ed	100 0
Undecene	3150 ug/m3	Deriv ed	100
m-Xylene	3000 ug/m3 (600 ppb)	Int MRL	90
o-Xylene	3000 ug/m3 (600 ppb)	Int MRL	90
p-Xylene	3000 ug/m3 (600 ppb)	Int MRL	90

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**Comparison Values for Specific Chemicals
In Water and Soil/Sediment/Dust**

Substance	Water	Soil¹⁰⁸	Basis¹⁰⁹	UF/MF¹¹⁰
Acenaphthene	600 ug/l	3000 mg/kg	RfD	3000
Acenaphthylene	3000 ug/l	20,000 mg/kg	RfD ¹¹¹	3000
Acetone	9000 ug/l	50,000 mg/kg	RfD	1000
Acetophenone	1000 ug/l	5000 mg/kg	RfD	3000
Aluminum	10,000 ug/l	50,000 mg/kg	Chr MRL	90
Anthracene	3000 ug/l	20,000 mg/kg	RfD	3000
Antimony	4 ug/l	20 mg/kg	RfD	1000
Arsenic	0.02 ug/l	0.5 mg/kg	Carc.	N/A ¹¹²
Barium	2000 ug/l	10,000 mg/kg	Chr MRL	300
Benzaldehyde	1000 ug/l	5000 mg/kg	RfD	1000
Benzene	0.6 ug/l	10 mg/kg	Carc.	N/A
Benzo(a)anthracene	0.005 ug/l	0.1 mg/kg	Carc. ¹¹³	N/A ¹¹⁴
Benzo(a)pyrene	0.005 ug/l	0.1 mg/kg	Carc.	N/A ¹¹⁵
Benzo(b)fluoranthene	0.005 ug/l	0.1 mg/kg	Carc. ¹¹⁶	N/A ¹¹⁷
Benzo(g,h,i)perylene	3000 ug/l	20,000 mg/kg	RfD ¹¹⁸	3000
Benzo(k)Fluoranthene	0.005 ug/l	0.1 mg/kg	Carc. ¹¹⁹	N/A ¹²⁰
Beryllium	20 ug/l	100 mg/kg	Chr MRL ¹²¹ *	300
Bis(2-ethylhexyl)Phthalate	2 ug/l	50 mg/kg	Carc	N/A ¹²²
Cadmium	1 ug/l	5 mg/kg	Chr MRL	3
Calcium	25,000 ug/l	105,000	DRI ¹²³	N/A
Carbon Disulfide	1000 ug/l	5000 mg/kg	RfD	100
Chlorobenzene	200 ug/l	1000 mg/kg	RfC	1000
Chloroform	100 ug/l	500 mg/kg	Chr MRL ¹²⁴	1000
Chromium III	20,000 ug/l	80,000 mg/kg	RfD	100
Chromium VI	10 ug/l	50 mg/kg	Chr MRL ¹²⁵	100
Chrysene	0.005 ug/l	0.1 mg/kg	Carc. ¹²⁶	N/A ¹²⁷
Cobalt	100 ug/l	500 mg/kg	Int. MRL	100
Copper	100 ug/l	500 mg/kg	Int. MRL	3
Cumene (aka, propyl benzene)	1000 ug/l	5000 mg/kg	RfD	1000
Dibenz(a,h)anthracene	0.005 ug/l	0.1 mg/kg	Carc. ¹²⁸	N/A ¹²⁹
Dibenzofuran	165 ug/l	825 mg/kg	Derived ¹³⁰	1000
Di-n-butyl phthalate	1000 ug/l	5000 mg/kg	RfC	1000
Diesel Range Petroleum (C8-26)	10,000 ug/l	10,000 mg/kg	Derived ¹³¹	100
Diethyl phthalate	8000 ug/l	40,000 mg/kg	RfD	1000
Di-n-octyl phthalate	4000 ug/l	20,000 mg/kg	Int. MRL	100
Diethyl Sulfosuccinate (DOSS)	6 ug/l	30 mg/kg	Derived ¹³²	N/A

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Dipropylene Glycol Butyl Ether	45,000 ug/l	225,000 mg/kg	Derived ¹³³	100
Docosane	1730 ug/l	8650 mg/kg	Derived ¹³⁴	100
Dotriacontane	1730 ug/l	8650 mg/kg	Derived ¹³⁵	100
Eicosane	1730 ug/l	8650 mg/kg	Derived ¹³⁶	100
Ethylbenzene	1000 ug/l	5000 mg/kg	RfD	1000
Fluoranthene	400 ug/l	2000 mg/kg	RfD	3000
Fluorene	400 ug/l	2000 mg/kg	RfD	3000
Freon 113 (aka 1,1,2-Trichloro-1,2,2-trifluoroethane)	300,000 ug/l	1,000,000 mg/kg	RfD	10
Gasoline Range Petroleum (C6-C12)	10,000 ug/l	10,000 mg/kg	Derived ¹³⁷	
Heneicosane	1730 ug/l	8650 mg/kg	Derived ¹³⁸	100
Hentriacontane	1730 ug/l	8650 mg/kg	Derived ¹³⁹	100
Heptacosane	1730 ug/l	8650 mg/kg	Derived ¹⁴⁰	100
Heptadecane	1730 ug/l	8650 mg/kg	Derived ¹⁴¹	100
Hexacosane	1730 ug/l	8650 mg/kg	Derived ¹⁴²	100
Hexadecane	1730 ug/l	8650 mg/kg	Derived ¹⁴³	100
Hopane	3000 ug/l	20,000 mg/kg	RfD ¹⁴⁴	3000
Indeno(1,2,3-cd)pyrene	0.005 ug/l	0.1 mg/kg	Carc. ¹⁴⁵	N/A ¹⁴⁶
Iron	1350 ug/l	13,500	DRI ¹⁴⁷	N/A
Lead	15 ug/l	400 mg/kg	EPA/ ¹⁴⁸ ATSDR	N/A
Magnesium	30,000 ug/l	150,000	DRI ¹⁴⁹	
Manganese	500 ug/l	3000 mg/kg	RfD	1
Mercury	3 ug/l	20 mg/kg ¹⁵⁰	Derived ¹⁵¹	100
Methylcyclohexane	50 ug/l	250 mg/kg	Derived ¹⁵²	
Methylene Chloride	5 ug/l	90 mg/kg	Carc ¹⁵³	N/A
Methyl Ethyl Ketone (2-Butanone)	6000 ug/l	30,000 mg/kg	RfD	1000
2-Methylnaphthalene	40 ug/l	200 mg/kg	RfD	1000
Naphthalene	700 ug/l	7000 mg/kg	Chr MRL	1000
Nickel	200 ug/l	1000 mg/kg	RfD ¹⁵⁴	300
Nonacosane	1730 ug/l	8650 mg/kg	Derived ¹⁵⁵	100
Nonadecane	1730 ug/l	8650 mg/kg	Derived ¹⁵⁶	100
Octacosane	1730 ug/l	8650 mg/kg	Derived ¹⁵⁷	100
Octadecane	1730 ug/l	8650 mg/kg	Derived ¹⁵⁸	100
Oil and Grease	10,000 ug/l	50,000 mg/kg ¹⁵⁹	NPDES ¹⁶⁰	
Oil Range Petroleum	10,000 ug/l	10,000 mg/kg	Derived ¹⁶¹	
Pentachlorophenol	0.3 ug/l	6 mg/kg	Carc/	N/A
Pentacosane	120,000 ug/l	600,000 mg/kg	Derived ¹⁶²	100
Perylene	3000 ug/l	20,000 mg/kg	RfD ¹⁶³	3000

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Assumptions and Comparison Values for Chemicals

Phenanthrene	3000 ug/l	20,000 mg/kg	RfD ¹⁶⁴	3000
Potassium	4000 ug/l	20,000 mg/kg	DRI ¹⁶⁵	N/A
Pyrene	300 ug/l	2000 mg/kg	RfD	3000
Selenium	50 ug/l	300 mg/kg	Chr. MRL *	3
Silver	50 ug/.	300 mg/kg	RfD	3
Sodium	1200 ug/l	6000 mg/kg	DRI ¹⁶⁶	N/A
Tetracosane	1730 ug/l	8650 mg/kg	Derived ¹⁶⁷	100
2,6,10,14-Tetramethyl Hexadecane	1730 ug/l	8650 mg/kg	Derived ¹⁶⁸	100
Tetratricontane	1730 ug/l	8650 mg/kg	Derived ¹⁶⁹	100
Thallium	0.5 ug/l	3 mg/kg	MCLG ¹⁷⁰	N/A
Toluene	200 ug/l	1000 mg/kg	Int. MRL	300
Total Organic Carbon (TOC)	50,000 ug/l	40,000 mg/kg	NPDES ¹⁷¹	
Total Petroleum Hydrocarbon	10,000 ug/l	10,000 mg/kg	Derived ¹⁷²	
Tricontane	1730 ug/l	8650 mg/kg	Derived ¹⁷³	100
Tricosane	1730 ug/l	8650 mg/kg	Derived ¹⁷⁴	100
Tritriacontane	1730 ug/l	8650 mg/kg	Derived ¹⁷⁵	100
Vanadium	100 ug/l	500 mg/kg	Chr. MRL	30
m-Xylene	2000 ug/l	10,000 mg/kg	Chr MRL ¹⁷⁶ *	1000

* Chronic MRL = RfD

¹ Pica is a syndrome which involves excessive hand to mouth activity. Such activity may increase exposure to substances on their hand. Pica behavior is most common in children, but can occur in adults. It is considered by ATSDR to be less significant in adults because of their increase weight and because adults tend to be able to control their activity better.

² Based on the RfC for Diesel Exhaust.

³ Based on the RfC for Diesel Exhaust.

⁴ Simple asphyxiant and flammable gas. Patty's, 2001 lists a animal NOAEL of 100,000 ppm; converting to mg/m³ and an UF of 100 yields 1065 mg/m³.

⁵ Based on the RfC for Diesel Exhaust.

⁶ Cancer comparison values are based on estimates of the relative statistical probability of a given increased incidence of cancer across a group of people over a lifetime. Uncertainty factors and modifying factors are not used in those statistics. Exposure durations under the current circumstances are presently unknown

⁷ Based on the 10-6 lifetime cancer risk for coke oven emissions reported on EPA's IRIS.

⁸ Based on the 10-6 lifetime cancer risk for coke oven emissions reported on EPA's IRIS.

⁹ Based on the 10-6 lifetime cancer risk for coke oven emissions reported on EPA's IRIS.

¹⁰ Based on the RfC for Diesel Exhaust.

¹¹ Based on the RfC for Diesel Exhaust.

¹² Based on the 10-6 lifetime cancer risk for coke oven emissions reported on EPA's IRIS.

¹³ Torti, 2001 reports an animal NOAEL of 10 ppm. Converting to 67 mg/m³ and adding a UF of 100 yields 670 ug/m³

¹⁴ No significant data. References made in HSDB to similarities with THMs. CV based on bromodichloromethane as a surrogate.

¹⁵ Patty's 2001 reports several occupational exposure standards from around the world. The Lowest OEL is from the UK at 600 mg/m³. Applying a modifying factor of 10 for time and other workplace protections and an uncertainty factor of 10 for human variability.

¹⁶ SIDS, 1995 reports an animal LOAEL of 11.5 g/m³. Applied an UF of 1000.

¹⁷ Armstrong, 1987 reports a animal LOAEL of 4000 mg/m³; applied UF of 1000.

¹⁸ Based on butylbenzene, cyclohexane, and the ratio of the CVs of benzene and butylbenzene, applied to the CV of

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Assumptions and Comparison Values for Chemicals

cyclohexane.

¹⁹ IUCLID, 2008 reports an animal LOAEL at 1.5 mg/l. Converting to mg/m³ and adding an UF of 1000 yields 1.5 ug/m³.

²⁰ ACGIH, 1991 reports an animal LOAEL of 21 mg/l. Converting to mg/m³ and adding an UF of 1000 yields 21 ug/m³.

²¹ Based on the 10-6 lifetime cancer risk for coke oven emissions reported on EPA's IRIS.

²² Based on the RfC for Diesel Exhaust.

²³ Patty's, 1994 reported an animal LOAEL of 8110 ppm or 23,249 mg/m³, but a report by the Netherlands government reported an animal LOAEL of 110 mg/m³ attributed to "CAV94". Applied an UF of 1000 to the CAV94 value

²⁴ Limited tox data. CHEMID reports an LClo of 16,000 ppm. TPH Profile approach is more conservative. Figure 6-12 in the ATSDR Total Petroleum Hydrocarbon Tox Profile shows an animal LOAEL for EC5-EC8 of 50 ppm. Converted to 139 mg/m³ and applied an UF of 1000.

²⁵ Kjaegaard, 1987 reports an animal NOAEL at 3140 mg/m³; applied an UF of 100 and rounded up to 31 mg/m³

²⁶ Based on the 10-6 lifetime cancer risk for coke oven emissions reported on EPA's IRIS.

²⁷ Based on bromodichloromethane as a surrogate.

²⁸ Cancer comparison values are based on estimates of the relative statistical probability of a given increased incidence of cancer across a group of people over a lifetime. Uncertainty factors and modifying factors are not used in those statistics. Exposures durations under the current circumstances are unknown.

²⁹ Cancer comparison values are based on estimates of the relative statistical probability of a given increased incidence of cancer across a group of people over a lifetime. Uncertainty factors and modifying factors are not used in those statistics. Exposures durations under the current circumstances are unknown.

³⁰ Patty's, 1963 reports an animal LOAEL of 400 ppm and a human LOAEL of 1000 ppm. Converting the animal figure to mg/m³ yields 2196 mg/m³; applied an UF of 1000.

³¹ Snyder, 1987 reported an animal LOAEL of 100,000 ppm. Use of TPH profile is more conservative. Figure 6-12 in the ATSDR Total Petroleum Hydrocarbon Tox Profile shows an animal LOAEL for EC5-EC8 of 50 ppm. Converted to 176 mg/m³ and applied an UF of 1000.

³² Based on dimethylbenzene, cyclohexane, and the ratio of the CVs of benzene and dimethylbenzene,(aka, xylene) applied to the CV of cyclohexane.

³³ Based on dimethylbenzene,decane, and the ratio of the CVs of benzene and dimethylbenzene (aka, xylene),applied to the CV of decane.

³⁴ Based on dimethylbenzene, heptane, and the ratio of the CVs of benzene and dimethylbenzene (aka xylene),applied to the CV of heptane.

³⁵ Based on dimethylbenzene, octane, and the ratio of the CVs of benzene and dimethylbenzene (aka, xylene),applied to the CV of octane.

³⁶ No significant tox data. Figure 6-12 in the ATSDR Total Petroleum Hydrocarbon Tox Profile shows an animal LOAEL for EC5-EC8 of 50 ppm. Converted to 204 mg/m³ and applied an UF of 1000.

³⁷ Based on dimethylbenzene, undecane, and the ratio of the CVs of benzene and dimethylbenzene,applied to the CV of undecane.

³⁸ Based on an animal NOAEL of 2010 mg/m³ reported in EPA's SIDS 2006. With UF of 100, CV becomes 20 mg/m³ or ~2.6 ppm.

³⁹ Fischader, 2008 reports an animal NOAEL of 100 g/m³; applied an UF of 100.

⁴⁰ SIDS, 2004 reported an animal LOAEL of 6884 mg/m³; applied an UF of 1000.

⁴¹ No significant tox data; one reviewer referred to this substance as toxicology inert. Figure 6-12 in the ATSDR Total Petroleum Hydrocarbon Tox Profile shows an animal LOAEL for EC5-EC8 of 50 ppm. Converted to 62 mg/m³ and applied an UF of 1000.

⁴² Derived from a human inhalation study in Patty's Industrial Hygiene (2001) reporting a LOAEL of 1380 ppm.

⁴³ Based on ethylbenzene, cyclohexane, and the ratio of the CVs of benzene and ethylbenzene,applied to the CV of cyclohexane.

⁴⁴ IARC, 1994 lists an animal NOAEL of 11,500 mg/m³. Applying a UF of 100 yields a CV of 115 mg/m³.

⁴⁵ Based on animal LOAEL reported in Swiercs R, Rydzynski K, Jaite J, Stetkiewicz J and Majcherek W, 2000 with an UF of 10 for use of a LOAEL, 10 for interspecies difference, and 10 for intraspecies sensitivities.

⁴⁶ Based on the RfC for Diesel Exhaust.

⁴⁷ Based on the RfC for Diesel Exhaust.

⁴⁸ Based on the RfC for Diesel Exhaust.

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Assumptions and Comparison Values for Chemicals

- ⁴⁹ Based on the RfC for Freon 22 (aka, chlorodifluoromethane) used as a surrogate.
- ⁵⁰ Based on the RfC for Freon 22 (aka, chlorodifluoromethane) used as a surrogate.
- ⁵¹ WHO, 1990 reports an animal LOAEL of 40 g/m³. Adjusted to ug/m³ and applied a UF of 1000.
- ⁵² National Academy of Science recommended a CEGL of 125 ppm or 875 mg/m³ for 90 day exposure on submarines. Added an uncertainty factor of 10 for intraspecies variations.
- ⁵³ Derived from a human inhalation study reported by the American Conference of Government and Industrial Hygienist (ACGIH) described in the Hazardous Substance Databank reporting a LOAEL of 1000 ppm.
- ⁵⁴ Limited data. Using the animal LOAEL of ~50 ppm from Figure 6-12 for C5-7 hydrocarbons and converting to mg/m³ results in 201 mg/m³. Applying the appropriate uncertainty factor of 1000 yields a CV of 201 ug/m³.
- ⁵⁵ SIDS, 2004 reports animal NOAEL of 300 ppm. Converting yields 1033 mg/m³; applied an UF of 100.
- ⁵⁶ Based on the 10-6 lifetime cancer risk for coke oven emissions reported on EPA's IRIS.
- ⁵⁷ Patty's 2001 reports a human NOAEL of 250 ppm while Aranyi, 1986 gives an animal NOAEL of 4500 ppm. Using the Patty's figure yields a human NOAEL of 594 mg/m³; applied an UF of 10.
- ⁵⁸ NTP, 1998 reports an animal NOAEL of 500 ppm while SIDS, 2005 reports an animal NOAEL of 2000 ppm. Using the NTP figure with a MW of 56.11 yields an animal NOAEL of 1147 mg/m³. UF of 100.
- ⁵⁹ Patty's, 2001 reports a human LOAEL of 270 mg/l. Converted to ug/m³ and applied a UF of 100.
- ⁶⁰ Based on an animal LOAEL of 2.2 mg/l reported by IUCLID. Adjusted to ug/m³ with an UF of 1000.
- ⁶¹ Derived using n-butane as a surrogate. An animal LOAEL of 5000 ppm butane was reported in Patty's Industrial Hygiene (2001). Using an UF of 1000 and converting to ug/m³ yields 12 mg/m³.
- ⁶² Limited data. Based on an animal LOAEL shown in Figure 6-12 of the TPH Tox Profile.
- ⁶³ Snyder, 1987 reported an animal NOAEL of 4.75 mg/l. Converting to ug/m³ and applying a UF of 100.
- ⁶⁴ Daughtrey et al, 1992 reports an animal NOAEL of 3000 ppm. Converting to mg/m³ and applying a UF of 100 gets us to 103 mg/m³.
- ⁶⁵ Based on methylbenzene, decane, and the ratio of the CVs of benzene and methylbenzene (aka, toluene), applied to the CV of decane.
- ⁶⁶ Cancer comparison values are based on estimates of the relative statistical probability of a given increased incidence of cancer across a group of people over a lifetime. Uncertainty factors and modifying factors are not used in those statistics. Exposures durations under the current circumstances are unknown.
- ⁶⁷ Swann, 1974 reported an animal LOAEL of 4672 mg/m³; applied an UF of 1000.
- ⁶⁸ No significant tox data. Figure 6-12 in the ATSDR Total Petroleum Hydrocarbon Tox Profile shows an animal LOAEL for EC5-EC8 of 50 ppm. Converted to 205 mg/m³ and applied an UF of 1000.
- ⁶⁹ Korsak reports an animal LOAEL of 67 mg/m³; applied an UF of 1000.
- ⁷⁰ Zahlsea, 1993, reports an animal LOAEL of 582 mg/m³; applied an UF of 1000.
- ⁷¹ Based on methylbenzene, octane, and the ratio of the CVs of benzene and methylbenzene (aka, toluene), applied to the CV of octane.
- ⁷² Using Pentane as a Surrogate. Stadler, et al, Drug & Chemical Toxicology (2001) reported an animal NOAEL at 1000 ppm supported by Browning, 1987 and Hurtt et al 1999. Applied a UF of 100 and converted to 29.5 mg/m³.
- ⁷³ No significant tox data. Figure 6-12 in the ATSDR Total Petroleum Hydrocarbon Tox Profile shows an animal LOAEL for EC5-EC8 of 50 ppm. Converted to 172 mg/m³ and applied an UF of 1000.
- ⁷⁴ Based on methylbenzene, undecane, and the ratio of the CVs of benzene and methylbenzene (aka, toluene), applied to the CV of undecane.
- ⁷⁵ Carpenter et al, 1978 reported a NOAEL at 1.9 mg/l in animals exposed for 13 weeks. Converted to mg/m³ and applied a UF of 100.
- ⁷⁶ Limited data. An animal LOAEL of 50 mg/m³ is listed in Figure 6-14 of the TPH Tox Profile.
- ⁷⁷ Based on an animal LOAEL reported in Patty's Toxicology 2001 of 35 mg/l. Converted to ug/m³ and applied an UF of 1000.
- ⁷⁸ Hempel-Jorgensen et al, 1999 reports a Human LOAEL of 6000 mg/m³. Applying a UF of 100 yields 60,000 ug/m³.
- ⁷⁹ NAAQS – National Ambient Air Quality Standard – 24 hour TWA
- ⁸⁰ NAAQS – National Ambient Air Quality Standard – 24 hour TWA
- ⁸¹ Stadler, et al, Drug & Chemical Toxicology (2001) reported an animal NOAEL at 1000 ppm supported by Browning, 1987 and Hurtt et al 1999. Applied a UF of 100 and converted to 29.5 mg/m³.
- ⁸² No significant tox studies. Figure 6-12 in the ATSDR Total Petroleum Hydrocarbon Tox Profile shows an animal LOAEL for EC5-EC8 of 50 ppm. Converted to 143 mg/m³ and applied an UF of 1000.
- ⁸³ Based on cyclohexane as a surrogate

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Assumptions and Comparison Values for Chemicals

⁸⁴ Based on the RfC for Diesel Exhaust.

⁸⁵ Based on the RfC for Diesel Exhaust.

⁸⁶ Wei, 2006 reports an animal NOAEL of 139 mg/m³; applied an UF of 100

⁸⁷ Based on estimates in NLM databases that propanol is twice as toxic as ethanol.

⁸⁸ Snyder, 1987 reports an animal NOAEL of 750 ppm. Converting to mg/m³ yields 1353 mg/m³; applied an UF of 100.

⁸⁹ Quest, 1984 reports a LOAEL of 5000 ppm in animals and Patty's 2001 lists an animal NOAEL of 625 ppm. Converted NOAEL to mg/m³ and applied an UF of 100.

⁹⁰ Walker, 2004 reports an animal NOAEL of 200 ppm. Converting to mg/m³ yields 344 mg/m³; applied an UF of 100.

⁹¹ Based on the RfC for Diesel Exhaust.

⁹² Based on the RfC for Diesel Exhaust.

⁹³ Robledo, 1999, reports an LOAEL on human lung tissue at 139 mg/m³; applied an UF of 100

⁹⁴ Mast, 1992 reports an animal NOAEL of 600 ppm. Converting to 1770 mg/m³ and adding an UF of 100 yields 17.7 mg/m³.

⁹⁵ Kociba, 1981 describes an animal LOAEL of 30 ppm while an EPA documents cites Coates, 1977 as determining an animal LOAEL of 25 ppm. Converting to ug/m³ and adding an uncertainty factor of 1000.

⁹⁶ Based on TCE, tetradecane, and the ratio of the CVs of TCE and PCE, applied to the CV of tetradecane.

⁹⁷ Limited data. Based on an animal LOAEL of 50 mg/m³ in Figure 6-14 of the TPH Tox Profile.

⁹⁸ Korsak, 2000 and Wiaderna, 1998 report similar LOAELs at 123 mg/m³. Applying a UF of 1000 yields 123 ug/m³.

⁹⁹ Derived from an animal NOAEL of 300 ppm reported in the Journal of Food and Chemical Toxicology by Saillenfait A, Gallissot F, Sabate J, and Morel G. July 2005

¹⁰⁰ Derived from an animal NOAEL of 100 ppm reported in the Journal of Food and Chemical Toxicology by Saillenfait A, Gallissot F, Sabate J, and Morel G. July 2005

¹⁰¹ Based on trimethylbenzene, cyclohexane, and the ratio of the CVs of benzene and trimethylbenzene, applied to the CV of cyclohexane.

¹⁰² Short et al., 1989 reports an animal LOAEL of 50 ppm. Converted to ug/m³ and applied an UF of 1000.

¹⁰³ LoF, 1999 reported an animal LOAEL at 2.29 mg/m³; applied an UF of 1000.

¹⁰⁴ No significant tox studies. Figure 6-14 in the ATSDR Total Petroleum Hydrocarbon Tox Profile shows an animal NOAEL for EC8-EC16 of 50 ppm. Converted to 315 mg/m³ and applied an UF of 100.

¹⁰⁵ MRL is for total Xylenes.

¹⁰⁶ MRL is for total Xylenes.

¹⁰⁷ MRL is for total Xylenes

¹⁰⁸ Soil includes sediment and dust.

¹⁰⁹ MRL = ATSDR Minimal Risk Levels as reported in appropriate Tox Profiles. Chr = Chronic Exposure (365 days or more). Int = Intermediate Exposure (14-364 days). Ac = Acute Exposure (14 days or less). RfD = EPA Reference Dose. Derived = Derived by staff for this review. DRI = Dietary Reference Intake.

¹¹⁰ UF = Uncertainty Factor associated by responsible staff with the underlying study. MF = Modifying Factor used in developing the standard. These compose the difference between the standard/guideline and the underlying research.

¹¹¹ Based on RfD for Anthracene as a surrogate.

¹¹² Cancer comparison values are based on estimates of the relative statistical probability of a given increased incidence of cancer across a group of people over a lifetime. Uncertainty factors and modifying factors are not used in those statistics. Exposures durations under the current circumstances are unknown.

¹¹³ Using B(a)P as a surrogate

¹¹⁴ Cancer comparison values are based on estimates of the relative statistical probability of a given increased incidence of cancer across a group of people over a lifetime. Uncertainty factors and modifying factors are not used in those statistics. Exposures durations under the current circumstances are unknown..

¹¹⁵ Cancer comparison values are based on estimates of the relative statistical probability of a given increased incidence of cancer across a group of people over a lifetime. Uncertainty factors and modifying factors are not used in those statistics. Exposures durations under the current circumstances are unknown.

¹¹⁶ Using B(a)P as a surrogate

¹¹⁷ Cancer comparison values are based on estimates of the relative statistical probability of a given increased

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Assumptions and Comparison Values for Chemicals

incidence of cancer across a group of people over a lifetime. Uncertainty factors and modifying factors are not used in those statistics. Exposures durations under the current circumstances are unknown.

¹¹⁸ Based on RfD for Anthracene as a surrogate

¹¹⁹ Based on Cancer risk for B(a)P as a surrogate.

¹²⁰ Cancer comparison values are based on estimates of the relative statistical probability of a given increased incidence of cancer across a group of people over a lifetime. Uncertainty factors and modifying factors are not used in those statistics. Exposures durations under the current circumstances are unknown.

¹²¹ Beryllium is considered carcinogenic by inhalation only.

¹²² Cancer comparison values are based on estimates of the relative statistical probability of a given increased incidence of cancer across a group of people over a lifetime. Uncertainty factors and modifying factors are not used in those statistics. Exposures durations under the current circumstances are unknown.

¹²³ Essential Nutrient. Based on Dietary Reference Intake

¹²⁴ Chloroform is considered carcinogenic by inhalation only.

¹²⁵ Chromium is considered carcinogenic by inhalation only.

¹²⁶ Based on cancer risk for B(a)P as a surrogate.

¹²⁷ Cancer comparison values are based on estimates of the relative statistical probability of a given increased incidence of cancer across a group of people over a lifetime. Uncertainty factors and modifying factors are not used in those statistics. Exposures durations under the current circumstances are unknown.

¹²⁸ Based on cancer risk on B(a)P as a surrogate.

¹²⁹ Cancer comparison values are based on estimates of the relative statistical probability of a given increased incidence of cancer across a group of people over a lifetime. Uncertainty factors and modifying factors are not used in those statistics. Exposures durations under the current circumstances are unknown.

¹³⁰ Based on an animal LOAEL of 16.5 mg/kg reported in Chaloupka et al, 1993. UF of 1000 applied.

¹³¹ Derived HGV of 1 mg/kg/day based on studies reported in ATSDR Tox Profile. HGV is 1-2 orders below known health effects described in Figures 6-9, 6-11, 6-13, 6-15, and 6-16.

¹³² DOSS is a food additive and pharmaceutical. As a drug, the recommended dose for a child is 5 mg/day. Lowest allowable tolerance established by FDA is 0.5 ug/g in sugar (21 CFR 172.810). Using USDA's Statistical Bulletin SB-965 (April 1999), the average American ingests 66.5 pounds per year of sugar. Calculating the dose of DOSS with conversions and using a 70 kg adult, the resulting daily dose is 0.6 ug/kg/day. Calculating forward with the standard assumptions for a child, the CVs were attained. Because this is a safe dose and is below the allowed dose when DOSS is used as a drug, no UF has been applied.

¹³³ Based on an animal NOAEL of 4500 mg/kg/day reported in EPAs SIDS database 2006.

¹³⁴ Long Chain Hydrocarbon; little or no absorption by mammals. Based on a mixture study of mineral oil, which contains many of the long chain hydrocarbons found in this oil, Smith et al, 1996 determined an animal LOAEL of 173 mg/kg/day. With a UF of 1000, this NOAEL is being used as surrogate for all Long Chain Hydrocarbons.

¹³⁵ Long Chain Hydrocarbon; little or no absorption by mammals. Based on a mixture study of mineral oil, which contains many of the long chain hydrocarbons found in this oil, Smith et al, 1996 determined an animal LOAEL of 173 mg/kg/day. With a UF of 1000, this NOAEL is being used as surrogate for all Long Chain Hydrocarbons.

¹³⁶ Long Chain Hydrocarbon; little or no absorption by mammals. Based on a mixture study of mineral oil, which contains many of the long chain hydrocarbons found in this oil, Smith et al, 1996 determined an animal LOAEL of 173 mg/kg/day. With a UF of 1000, this NOAEL is being used as surrogate for all Long Chain Hydrocarbons.

¹³⁷ Derived HGV of 1 mg/kg/day based on studies reported in ATSDR Tox Profile. HGV is 1-2 orders below known health effects described in Figures 6-9, 6-11, 6-13, 6-15, and 6-16.

¹³⁸ Long Chain Hydrocarbon; little or no absorption by mammals. Based on a mixture study of mineral oil, which contains many of the long chain hydrocarbons found in this oil, Smith et al, 1996 determined an animal LOAEL of 173 mg/kg/day. With a UF of 1000, this NOAEL is being used as surrogate for all Long Chain Hydrocarbons.

¹³⁹ Long Chain Hydrocarbon; little or no absorption by mammals. Based on a mixture study of mineral oil, which contains many of the long chain hydrocarbons found in this oil, Smith et al, 1996 determined an animal LOAEL of 173 mg/kg/day. With a UF of 1000, this NOAEL is being used as surrogate for all Long Chain Hydrocarbons.

¹⁴⁰ Long Chain Hydrocarbon; little or no absorption by mammals. Based on a mixture study of mineral oil, which contains many of the long chain hydrocarbons found in this oil, Smith et al, 1996 determined an animal LOAEL of 173 mg/kg/day. With a UF of 1000, this NOAEL is being used as surrogate for all Long Chain Hydrocarbons.

¹⁴¹ Long Chain Hydrocarbon; little or no absorption by mammals. Based on a mixture study of mineral oil, which contains many of the long chain hydrocarbons found in this oil, Smith et al, 1996 determined an animal LOAEL of 173 mg/kg/day. With a UF of 1000, this NOAEL is being used as surrogate for all Long Chain Hydrocarbons.

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Assumptions and Comparison Values for Chemicals

- ¹⁴² Long Chain Hydrocarbon; little or no absorption by mammals. Based on a mixture study of mineral oil, which contains many of the long chain hydrocarbons found in this oil, Smith et al, 1996 determined an animal LOAEL of 173 mg/kg/day. With a UF of 1000, this NOAEL is being used as surrogate for all Long Chain Hydrocarbons.
- ¹⁴³ Long Chain Hydrocarbon; little or no absorption by mammals. Based on a mixture study of mineral oil, which contains many of the long chain hydrocarbons found in this oil, Smith et al, 1996 determined an animal LOAEL of 173 mg/kg/day. With a UF of 1000, this NOAEL is being used as surrogate for all Long Chain Hydrocarbons.
- ¹⁴⁴ Based on RfD for Anthracene as a surrogate.
- ¹⁴⁵ Based on cancer risk of B(a)P as a surrogate.
- ¹⁴⁶ Cancer comparison values are based on estimates of the relative statistical probability of a given increased incidence of cancer across a group of people over a lifetime. Uncertainty factors and modifying factors are not used in those statistics. Exposures durations under the current circumstances are unknown.
- ¹⁴⁷ Essential Nutrient. Based on Dietary Reference Intake
- ¹⁴⁸ For Lead, the water CV is the EPA Action Level as recommended by CDC. The soil CV is a screening level used by agreement between EPA and ATSDR. See 40 CFR 745.
- ¹⁴⁹ Essential Nutrient. Based on Dietary Reference Intake
- ¹⁵⁰ Screening level recommended by ATSDR for Oak Ridge Superfund Site.
- ¹⁵¹ Based on RfD for mercuric chloride.
- ¹⁵² No data available. Statement in HSDB equates methylcyclohexane to heptanes (4000 mg/kg) and octane (0.005 mg/kg); given 6 orders of magnitude, equated the HGV to octane as a surrogate.
- ¹⁵³ Cancer comparison values are based on estimates of the relative statistical probability of a given increased incidence of cancer across a group of people over a lifetime. Uncertainty factors and modifying factors are not used in those statistics. Exposures durations under the current circumstances are unknown.
- ¹⁵⁴ Nickel is considered carcinogenic by inhalation only.
- ¹⁵⁵ Long Chain Hydrocarbon; little or no absorption by mammals. Based on a mixture study of mineral oil, which contains many of the long chain hydrocarbons found in this oil, Smith et al, 1996 determined an animal LOAEL of 173 mg/kg/day. With a UF of 1000, this NOAEL is being used as surrogate for all Long Chain Hydrocarbons.
- ¹⁵⁶ Long Chain Hydrocarbon; little or no absorption by mammals. Based on a mixture study of mineral oil, which contains many of the long chain hydrocarbons found in this oil, Smith et al, 1996 determined an animal LOAEL of 173 mg/kg/day. With a UF of 1000, this NOAEL is being used as surrogate for all Long Chain Hydrocarbons.
- ¹⁵⁷ Long Chain Hydrocarbon; little or no absorption by mammals. Based on a mixture study of mineral oil, which contains many of the long chain hydrocarbons found in this oil, Smith et al, 1996 determined an animal LOAEL of 173 mg/kg/day. With a UF of 1000, this NOAEL is being used as surrogate for all Long Chain Hydrocarbons.
- ¹⁵⁸ Long Chain Hydrocarbon; little or no absorption by mammals. Based on a mixture study of mineral oil, which contains many of the long chain hydrocarbons found in this oil, Smith et al, 1996 determined an animal LOAEL of 173 mg/kg/day. With a UF of 1000, this NOAEL is being used as surrogate for all Long Chain Hydrocarbons.
- ¹⁵⁹ Calculated from NPDES general permit for water.
- ¹⁶⁰ NPDES Storm Water General Permit;
- ¹⁶¹ Derived HGV of 1 mg/kg/day based on studies reported in ATSDR Tox Profile. HGV is 1-2 orders below known health effects described in Figures 6-9, 6-11, 6-13, 6-15, and 6-16.
- ¹⁶² Long Chain Hydrocarbon; little or no absorption by mammals. Based on a mixture study of mineral oil, which contains many of the long chain hydrocarbons found in this oil, Twitter et al, 2004 determined an animal NOAEL of 1200 mg/kg. With a UF of 100, this NOAEL is being used as surrogate for all Long Chain Hydrocarbons.
- ¹⁶³ Based on RfD for anthracene as a surrogate.
- ¹⁶⁴ Based on RfD for anthracene as a surrogate.
- ¹⁶⁵ Essential Nutrient. Based on Daily Recommended Intake
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- ¹⁶⁹ Long Chain Hydrocarbon; little or no absorption by mammals. Based on a mixture study of mineral oil, which contains many of the long chain hydrocarbons found in this oil, Smith et al, 1996 determined an animal LOAEL of 173 mg/kg/day. With a UF of 1000, this NOAEL is being used as surrogate for all Long Chain Hydrocarbons.

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Assumptions and Comparison Values for Chemicals

¹⁷⁰ MCLG is the Maximum Contaminant Level Goal in drinking water; sediment value calculated from the equivalent dose associated with the MCLG.

¹⁷¹ NPDES Storm Water General Permit

¹⁷² Based on CVs for DRO, GRO, and ORO above.

¹⁷³ Long Chain Hydrocarbon; little or no absorption by mammals. Based on a mixture study of mineral oil, which contains many of the long chain hydrocarbons found in this oil, Smith et al, 1996 determined an animal LOAEL of 173 mg/kg/day. With a UF of 1000, this NOAEL is being used as surrogate for all Long Chain Hydrocarbons.

¹⁷⁴ Long Chain Hydrocarbon; little or no absorption by mammals. Based on a mixture study of mineral oil, which contains many of the long chain hydrocarbons found in this oil, Smith et al, 1996 determined an animal LOAEL of 173 mg/kg/day. With a UF of 1000, this NOAEL is being used as surrogate for all Long Chain Hydrocarbons.

¹⁷⁵ Long Chain Hydrocarbon; little or no absorption by mammals. Based on a mixture study of mineral oil, which contains many of the long chain hydrocarbons found in this oil, Smith et al, 1996 determined an animal LOAEL of 173 mg/kg/day. With a UF of 1000, this NOAEL is being used as surrogate for all Long Chain Hydrocarbons.

¹⁷⁶ MRL is for mixed xylenes